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SECRETACTIVATION OF LIPASE BY SOME GROWTH STIMULANTS

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(Submitted by Academician

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The study of growth stimulants has shown that they are capable of producing anatomic-morphological, physiological and biochemical changes in the organism of plants [1]. However, little work has been devoted to biochemical research, in particular to the action of these substances on the biochemical processes connected with the dynamics of the enzyme mechanism of plants.

It is interesting to examine the effect of such growth stimulants as β -indole acetic acid, α -naphthyl butyric acid, and 2,4-dichlorophenoxy acetic acid on the activity of lipase.

The activation of lipase was carried out by the method of Wellbahl and Onslow [2] on castor seeds [2]. The castor seeds, cleaned of their hulls and ground to a uniform mass, were steeped in acetic acid (control) and in the acids mentioned above.

The acids were tested in various combinations and concentrations, mostly, 0.01 N solutions were used.

The flasks with the samples were kept in a thermostat at 37°C. A variation was introduced into the experiment by infiltrating the test material with the acids. The infiltration was carried out after keeping the material in the thermostat for 20 minutes. The investigations made according to the scheme below were repeated three times. Similar results were obtained in all cases. Some of them are cited in Table I.

On the basis of the analysis of the experiments performed, the following conclusion can be made: infiltration increases the activation of lipase by all the acids used in the experiment, especially by β -indole acetic acid.

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The degree of activation of lipase both by growth stimulants and by acetic acid depends on the time of storage of the test material in the thermostat. Activation after 12 hours' standing is greater than after two hours.

According to the activation of lipase, the growth stimulants and acetic acid can be arranged in the following descending order:

In the first series of experiments: 2, 4-dichlorophenoxy acetic acid > acetic acid > β -indole acetic acid + 2, 4-dichlorophenoxy acetic acid > β -indole acetic acid.

In the second series of experiments: β -naphthyl acetic acid > 2, 4-dichlorophenoxy butyric acid > β -naphthyl acetic acid + 2, 4-dichlorophenoxy butyric acid > acetic acid.

Pure β -naphthyl acetic acid and pure 2,4-dichlorophenoxy butyric acid are always highly active in all variations. The weakest of all growth stimulants in the pure form, in comparison with acetic acid, is β -indole acetic acid (first series).

It is interesting that 2, 4-dichlorophenoxy acetic acid in a mixture with β -indole acetic acid (1:1 ratio) increases the activity of the latter, while β -indole acetic acid, in turn, reduces the activity of 2, 4-dichlorophenoxy acetic acid. Thus, the activity of the above mixture occupies an intermediate position between the two components taken in the pure state.

The mixture of β -indole acetic acid and 2, 4-dichlorophenoxy acetic acid occupies the last place after these acids taken in the pure state (second series), as regards its activating effect on lipase. This confirms the fact that these acids, in the given combination, lose their function as lipase activators upon 12 hours of storage in the thermostat.

These results shed light on the fact that growth stimulants lose their function as activators at several stages of the ontogenesis of plants.

The organism of plants is a system of organs in a correlation based on polarly opposite relationships. Antagonism between organs appears as a result of their different rates of development, as they came into being at different times in the course of the evolutionary process.

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plastic substances [plastid substances] produced by an organ completely formed in regard to age may, upon entering the general metabolism or growth, lose their activating effect in individual stages of ontogenesis, entering into complex compounds with substances formed in some other organ.

Or, conversely, in such a combination, inhibitors may turn into activators, especially in a case where the external environment sharply changes the metabolism of the organ. This can be observed, in short-day plants upon transferring them from a long to a short day. At that time, the growth processes which had been proceeding intensively until then are greatly slowed down or even stopped altogether as a result of the profound change in the metabolism of the leaf apparatus which is beginning to form specific nutrient substances [5, 47].

We find indications in many works [5-7] on the inhibition reactions which take place when, for instance, glucosides are suppressed by the corresponding sugars, peptidases by amino acids, etc.

Academician H. A. Maksimov explains the nature of the action of growth stimulants by the fact that these substances affect the permeability of the plasmatic cell membrane and thus increase the admittance of water and dissolved substances into the cell [5, 97].

According to contemporary findings, the plasmatic membranes are composed partially of fats and fat-like substances (lecithin and other lipoids), many of which are decomposed by lipases.

Our experiments on the activation of lipase by growth stimulants permit us to express the following conclusion about the mechanism of their action in the cell: Activated lipases split off fatty acids from lecithins which enter into the composition of the plasmatic membrane. As a result, the micro-structure of the membrane is changed in such a manner that the permeability for various nutrient substances is increased. Consequently, the transport of such substances into the cell is greatly intensified.

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Table I

ml of 0.1 n KOH used for titration after storage in thermostat

name of acids acting as growth-stimulants (0.01 n solution)	12 hrs without infiltration	12 hrs with infiltration	2 hrs without infiltration	2 hrs with infiltration
First Series				
2, 4-dichlorophenoxy acetic acid	13.1	14.75	11.7	12.65
3-indole acetic acid + 2, 4 dichlorophenoxy acetic acid	11.3	13.95	11.0	12.1
2-indole acetic acid	10.4	11.95	7.7	9.3
Acetic acid	11.7	12.65	10.5	11.25
Second Series				
3-naphthyl acetic acid	16.3	20.6	15.7	19.7
2, 4-dichlorophenoxy butyric acid	15.6	16.25	11.7	13.7
3-naphthyl acetic acid + 2, 4-dichlorophenoxy butyric acid	15.0	17.7	12.2	14.9
Acetic Acid	12.3	13.55	10.8	11.5

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